process know what has already been done; while the general public ought not to remain ignorant of what legitimately belongs to them, and which, after the ample reward he has received for his inventions, the author desires they should enjoy without any restrictions. The author of the second paper holds that the making of steel in small quantities is a step in the wrong direction, because the steel cannot be made so cheaply; but, as he points out, it is to the interest of owners of small blast plant to possess the means of converting their product into steel, and of ironworkers who cannot find work for their puddling furnaces to make steel enough to keep their machinery at work rather than be dependent on larger firms for a supply of ingots. An American steel-maker in the discussion drew attention to the circumstance that in the United States, when the rail trade was brisk, it was impossible for the smaller works to obtain Bessemer ingots at all, and that they had to introduce small plant for self-preservation. From the statement of opinion it was evident that there was necessity for the original Bessemer converters and the smaller modified forms.

Mr. Frederick Siemens's paper on combustion with special reference to practical requirements draws attention to the means necessary for adoption to insure perfect combustion. The gases must be supplied in the exact chemical proportion in which they are required for combustion; they must be brought together in such a manner that the different molecules which have to enter into combination may readily do so, whilst every thing must be avoided which interferes with the motion of the gases while combustion is proceeding.

The author enters in detail on the way in which gases should be brought together, he explains that the Bunsen burner, though theoretically perfect, cannot be advantageously carried out in furnaces, as the flame of a Bunsen burner being almost non-luminous owing to free carbon not being liberated during combustion, has but little radiating power, and must in consequence transmit its heat by direct contact only. As the gases cannot generally be mixed before combustion, it is a matter of great importance how they are brought together when combustion commences, a mean being necessary between a too intimate mixture, producing a short flame having great heating but little radiating power, and an imperfect mixture, which does not allow of combination properly taking place. The third means necessary is the one to which the author has frequently drawn special attention, because neither the employment of gases in proper proportion, nor their proper mixture is sufficient to insure perfect combustion *if the disturbing influences of surfaces is allowed to interfere to prevent combustion, or to dissociate particles of gas already combined.* In the author's view the dissociation caused by hot surfaces is of various kinds, and takes place at different temperatures. At a comparatively low temperature, dissociation of hydrocarbons takes place, the carbon being liberated in the solid form as soot. At a moderately high temperature carbonic oxide is dissociated into solid carbon and carbonic acid gas; at a higher temperature the products of combustion begin to dissociate, steam splitting up into hydrogen and oxygen, and lastly, at a still higher temperature, depending upon the kind of surface with which the products of combustion come into contact, carbonic acid splits up into solid carbon and oxygen. From this it will be seen that dissociation has the effect of setting carbon free, and to its influence the formation of smoke is largely due.

The author then proceeded to show that smoke within a furnace chamber is caused by flame in the first instance touching surfaces which then become enveloped in a dense cloud of dissociated carbon, which prevents the heat rays from reaching them. The author illustrated his remarks by means of a gas-burner proposed to be used instead of the English fire-place, by the use of which it is stated that heat is much more uniformly distributed throughout a room. The flame was intensely bright and hot, due as explained to its being fed with hot air, and working with free development of flame that is entirely out of contact with any surfaces. The gas stove afforded considerable interest to the members, and the author by special request explained its mode of action.

The papers read on the last day of the meeting were two by Mr. F. Gautier, of Paris, on the casting of chains in solid steel, and on silicon in foundry iron. Hitherto chains have been made of wrought iron, the difficulty in the various processes of manufacture being the difficulty of securing a good weld; this, according to the author, is now overcome by a process of Messrs. Joubert and Leger, of Lyons, which combines chilled casting and instantaneous removal from the moulds. In the second paper the writer refers to the advantage of silicon in producing homogeneous steel and pig iron castings and improving foundry pig; he also drew attention to the introduction of ferrosilicon in French foundry practice. The author's views were in general supported by the members in discussion. Mr. F. W. Harbord's paper, "On the Elimination of Silicon, Phosphorus, &c., in the Basic Open-hearth Process," gave evidence that soft steel of the very finest quality could be produced from inferior material by this process, whilst the conditions of working in the Siemens furnace are peculiarly favourable to its production. Surgeon-Major Hendley's paper, "On the Process employed in Casting Brass Chains at Jeypore, Rajputana," was contributed by Mr. C. Purdon Clarke, and illustrated by samples. The papers on "Chrome Steel," by Mr. Brustlem, and on "American Blast Furnace Practice," by Mr. F. W. Gordon, Philadelphia, were put off to the next meeting.

NOTES

WE regret to learn that Baron von Müller retires from the directorship of the Melbourne Botanic Gardens in June next.

THE death is announced of M. Dubosc, a Paris optician, who assisted M. Léon Foucault in all his constructions, and especially in the organisation of his automatic electric lamp.

THE Laboratoire d'Électricité created with the surplus of the Electrical Exhibition of 1881, held in the Palais de l'Industrie, will be erected on the site of the old Collège Rollin, on ground granted by the City of Paris. It will be open to electricians of every nation, and governed by the International Society of Electricians.

AN ordinary General Meeting of the Institution of Mechanical Engineers will be held in the Yorkshire College, Leeds, on Monday, October 18, by invitation of the College authorities, in celebration of the opening of the Engineering Department of the College. The following papers will be read and discussed, as far as time permits:—"On Triple-Expansion Marine Engines," by the late Mr. Robert Wyllie, of Hartlepool; "Notes on the Pumping Engines at the Lincoln Water-Works," by Mr. Henry Teague, of Lincoln; "Description of a Portable Hydraulic Drilling Machine," by M. Marc Berrier-Fontaine, of Toulon.

THE Commission of the French Budget having adopted without reduction all the proposals of the Government for the Algerian provinces, the construction of the large instruments for Bouzareah Observatory will be continued, and inspection of the heavens will be conducted on a large scale at Algiers. An observer connected with the Trocadero Observatory has been appointed to assist M. Trépied, and left Paris last week for his destination.

THE photographic method has been established at the Algiers Observatory for the sun. Nine times out of ten the operation has been successful.

The Duc d'Aumale has bequeathed to the Institute of France in perpetuity the mansion and domain of Chantilly, with its museum and all its other contents, to be preserved and maintained for the benefit of the French nation. This munificent gift is fettered by no conditions beyond those necessary for carrying out the main purpose of the testator. The value of the gift is estimated at thirty millions of francs, or nearly a million and a quarter sterling, and the income for maintaining it at 20,000*l.* per annum.

Some time since, Herr Paul von Ritter, of Basle, gave the sum of 300,000 marks for the furtherance of scientific inquiry on the basis of the Darwinian theory. It has now been decided to employ half the interest in the maintenance of a "Ritter Professorship of Philogeny." The chair is to be filled by Dr. Arnold Lang, formerly scholar and assistant of Prof. Haeckel at Jena. Dr. Lang has for several years taken part in the work of the Zoological Station at Naples. The other half of the interest will be expended in grants for scientific travel, and in furnishing improved means of instruction in zoology at this University. Herr von Ritter has been made Doctor of Philosophy *honoris causâ.*

Since the end of 1883, regular observations of atmospheric electricity have been made at the Odessa Meteorological Observatory, and M. Klossofsky shows by the graphic method (*La Nature*) how there is an intimate relation between the variations of atmospheric pressure, and those of electric potential. Cyclonic movements of the atmosphere find a faithful echo in the indications of the electrometer, though sometimes mist, smoke, dust, and atmospheric precipitates may for a time mask the correspondence.

In the course of a review in the *Chinese Recorder* of a new Chinese geometry by Dr. Mateer, Dr. Martin, the head of the Foreign Language College at Pekin, states that the first translation of Euclid into Chinese was made by the illustrious Father Ricci, "the apostle at once of religion and science." In time the paramount influence of Euclid grew into something like a bondage in the east as well as in the west. In the west a wholesome revolt took place long ago, but in China Euclid "has reigned with undisputed sway for three centuries, and nothing has been done even in the way of simplification until the work of Dr. Mateer. It is a strange fact that Ricci's Euclid was left standing through all these ages in the condition of a truncated pyramid. Only six books were translated by the great Jesuit, and the remaining nine were supplied about thirty years ago by Mr. A. Wylie, aided by Prof. Li Shenlon." Mr. Wylie subsequently translated Loomis's "Analytical Geometry and Differential Calculus"; but, says Dr. Martin, he would have done better to have commenced his mathematical textbooks by a version of Loomis's "Geometry," which, following the footsteps of Legendre, presents the whole subject in a compact and easily intelligible form. The translation of the Chinese titte of the older book is "First Book in the Science of Quantity"; that of Dr. Mateer's is "The Science of Form." A Chinese mathematician's view of the new work is given by Dr. Martin in the following words:—"This book presents the principles of geometry in a more concise form than Euclid, and omits nothing of importance that is found in Euclid. Besides the chapter on the three round bodies, there are throughout many excellent theories that were unknown to Euclid, especially those relating to spherical triangles, so essential to the study of astronomy." The price of the two volumes, it may be added, is about 2*s.* 3*d.*

The number of the *Folk-Lore Journal* (vol. iv. part 4) just published, contains the first instalment of a paper by Capt. A. C. Temple, which promises to be the most important work yet published on the folk-lore of North-Western India. The writer has made it a practice to collect all the popular works published in the Punjaub relating to history, folk-lore, and religion. He has now about 350 of these in Arabic, Persian, Urdu, Hindi, Punjaubi, Pushtoo, and Sanscrit. It faithfully represents the current popular literature of the day in the Punjaub. Capt. Temple has had abstracts of the books prepared, and twenty-eight of these are published in the present paper. In the somewhat distant future when the whole 350 are published, few regions will have had their folk-lore so thoroughly investigated as the Punjaub.

According to *Die Natur* a remarkable collection of minerals exists in the cellars of the Academia San Fernando at Madrid. It is contained in a number of boxes which have filled the cellars for about 200 years, and which may remain there as long again unless some better fortune befalls them than that which has attended them in the past. They come down from the golden age of Spanish domination in South America and in Mexico, when the mines of these regions made them the El Dorado of the globe. No one knows exactly the contents of the boxes, but they are believed to contain the rarest objects, although the scientific importance of collections was but little appreciated in the days when this one was made. It appears also that collections made by Humboldt during his travels in America, and handed over by him as a kind of scientific tribute to the Spanish Government, are in the same Academy "locked up since 1804 in a press, untouched." With respect to the famous skeleton of the *Megatherium americanum*, Cuv., found by the Marquis de Loreto on the banks of the Rio Luxon near Buenos Ayres in 1778, which is in the Museum of the Academy, its present state is described by the brothers Fraas of Stuttgart in their letters from the south of France and Spain, just published under the title of "Aus dem Süden," as being one of the utmost confusion. The bones are bored for mounting, but they are "completed and restored" to the verge of the impossible. The bones are placed in absurd positions, and parts which were inconvenient to the mounter are put aside altogether. The writers ask what the state of instruction in natural history must be in an Academy where such things are possible.

We have never heard an adequate explanation of the extraordinary delay which takes place in the issue of the Annual Reports of the Japanese Ministry of Education. They are as a rule three years behind time. That for 1882 has only just been published. They contain a considerable number of statistics, but this alone would not account for the delay, for the publications of, say, the Japanese Meteorological Observatory contain far more and more complicated tables, yet the latter appear in reasonable time. It is very difficult to feel any interest in an annual report of the year 1882 at this date; conditions have altered, the circumstances are different, the inspector's report for 1885 may show energy and success where those of 1882 had to reveal apathy and ignorance. The Tokio University, for example, has been wholly remodelled, and one reads with very languid interest now that in 1882 there were such and such departments, so many graduates, and the like. The details in the report, especially those relating to students abroad, to the position of libraries and museums, their utility to and appreciation by the public, would be of interest and well worth quotation, or at least a short summary, if they were those of last year instead of those of four years ago. These reports may perhaps be of use to any one who undertakes to write a history of education in Japan; for any practical present use they are they might as well remain unpublished in the Archives of the Education Department in Tokio. We can perceive nothing in the nature of things, or in the design or details of the reports to prevent them being produced regularly in the first half of the year succeeding that to which they refer.

In a very interesting paper in the new number of the *Asiatic Quarterly Review*, Miss E. M. Clerke, writing on "Arabic Analogies in Western Speech," says that whole classes of astronomical, astrological, and generally scientific terms are a standing memorial to the debt of culture Europe owes to the East. Logarithm is a corruption of *el-jouarzeem*, and algebra of *el-jabr wa'lmukábala*, literally, the integration and comparison. Alembic is *el-anbik*, a retort, whence the Italian *lambiccare*, to distil; and nearly all the terms used in alchemy denote its Oriental origin. Star-names come from the same source: Algol is *el-ghol*, the ghoul; and Vega, a fragment of *nasser-el-waga*, the falling eagle. Most precious stones and minerals, as sapphire, emerald, bezoar, jasper, amber, antimony, are transparent disguises of Arabic originals; jewel itself is from *jouhour*. Similarly the names of poisons and remedies, as well as maladies, come from Arabia: thus arsenic is *ez-zernikh;* massage, the fashionable cure by friction, is from *mass*, to handle, and leprosy is an obvious corruption of *el-abras*. Again, such words as spinach, endive, chicory, saffron, arrowroot, cotton, hemp, carraway, cummin, and aloe are obvious derivatives from Arabic. The names of many flowers come from Arabia, by adoption from Persian, also fruits, as lemon and orange. Carat is an Arabic weight. Monsoon comes from *mousem*, a fixed time, and sirocco and simoom. These and a hundred others given by Miss Clerke "go to prove that the world is one vast commonwealth of ideas, most widely shared by the classes least conscious of their indebtedness to foreign influence."

Father Dechevrens, of the Siccawei Observatory near Shanghai, writing on a violent typhoon which visited that district on August 14, doing considerable damage, says that it was remarkable by the long persistency of the low pressures that continued from 3 a.m. on the 14th to 5 a.m. on the 18th, that is, ninety-three hours, during the whole of which time the wind blew hard, and during the two last days the rainfall rose from 6 inches to 12. He says this is a singular and very rare phenomenon, and to explain it he follows the typhoon all along its course. Like the typhoon of the same date in 1881, it came from the open sea. On the 11th the barometer at Manilla caused suspicion of a storm to the north-east of Luzon and east of Formosa. The Loochoo Islands must have been passed on the afternoon of the 13th, and at noon on the 14th it reached the coast of China about Wenchow. Having got to the mainland, the storm proceeded for some time to the west through the province of Kiangsi, and then was divided. One part recurved to the south-west towards Kwangsi and Tonquin, and is easily followed by observations made at Amoy and Hong Kong; the other part of the depression turned round to the north and got nearer to the Yang-tse River. On the morning of the 18th an entire change took place in the atmospheric conditions. The second depression was in its turn divided, and while the portion higher in latitude formed itself into a distinct storm and got away to the north, the other part approached Shanghai and put back to sea through the mouth of the Yang-tse. When Shanghai was placed between the two depressions, the air, not knowing, as it were, towards which of them to flow, got rapidly calm. While the two centres were thus getting away in opposite directions, the Siccawei barometer rose without any strong wind blowing. This, concludes Father Dechevrens, is a new phase of this singular typhoon, the centre of which passed very close to Shanghai without giving birth to any gale, except the one that had preceded the division and the departure. It is to be hoped that the learned writer may be able to give this typhoon, with the peculiarities here noted, the same detailed and thorough study that he gave that of 1881. In the latter instance he gave what may be called the life-history of a storm from its birth in the China Seas, almost to its dissipation far in the interior of he continent of Asia.

The luminosity of insects has been lately studied in a very careful manner by Dr. Dubois, one of M. Bert's students. The animal selected was the American *cucujo*, or *Pyrophorus noctilucus*. It has three luminous organs—two prothoracic and one ventral. Dr. Dubois opposes the view that the light results from direct oxidation of the substance of the luminous organs, by oxygen of the air coming through the tracheæ. In pure oxygen the luminosity is the same as in air, and it is the same in pressures under one atmosphere. Nor does compressed oxygen affect it, and this gas cannot restore the light when extinct in organs which yet respond to mechanical agents or electricity, even when the pressure is raised to four atmospheres. The prothoracic plates give a good illumination in front, laterally, and above, and serve when the insect walks in the dark; when it flies or swims, its fine abdominal lantern is unmasked (and the abdomen raised) throwing downwards an intense light with much greater range. The insect seems to be guided by its own light. If the prothoracic apparatus is quenched on one side with a little black wax, the cucujo walks in a curve, turning towards the side of the light. If both sides are quenched, the insect walks hesitatingly and irregularly, feeling the ground with its antennæ, and soon stops. The light of the cucujo gives a pretty long spectrum from the red to the first blue rays; when the light diminishes, this shortens somewhat on the side of the blue, but more on the other side. The maximum is about wave-length 528 μ 56 (as in the solar spectrum). The light is more green than that of *Lampyris noctiluca*. It is capable of photography, but does not develop chlorophyll. The prothoracic organs of six insects did not set a radiometer in motion, but they affected a Melloni pile slightly. No distinct electric action could be traced in the organs. Separated from the body, the organs are still brilliant. If the insect is deprived of water, it ceases to produce light; and it recovers the power when plunged in water. The eggs may be dried to the extreme limit, at ordinary temperature, without losing their light-yielding power; put in water after eight days even, they become luminous again. Further, if the luminous organs are dried *in vacuo*, and pulverised in a mortar, a little water (even if freed from gas by boiling) makes the mass luminous throughout. Dr. Dubois finds the photogenic substance to be an albuminoid, soluble in water and coagulable by heat; it enters into conflict with another substance, of the diastase group, and part of the energy thus liberated appears as light.

Some experiments lately brought before the Paris Academy by M. Luvini, combine with those of other observers (he considers) in warranting the conclusion that "gases and vapours, under any pressure, and at all temperatures, are perfect insulators, and cannot be electrified through friction, either with one another, or with solid or liquid substances."

The *Giornale d'Agricoltura e Commercio* for August reports the discovery in West Africa of a new variety of coffee-plant, whose berry appears greatly to resemble that of Arabia in appearance and flavour. It grows, however, not on a shrub but on a tree nearly 7 feet high, which develops rapidly and yields an abundant crop. Arrangements are already being made for introducing its cultivation in favourable localities.

The additions to the Zoological Society's Gardens during the past week include a Brown Capuchin (*Cebus fatuellus* ♀) from Guiana, presented by Messrs. Kühner, Hendschel, and Co.; a Macaque Monkey (*Macacus cynomolgus* ♀) from India, presented by the Countess de Geloes; a Yellow-footed Rock Kangaroo (*Petrogale xanthopus* ♀) from South Australia, presented by Mr. G. Langborne, Chief Officer s.s. *Rome;* a Common Squirrel (*Sciurus vulgaris*), British, presented by Miss Gertrude Hudson; two Lanner Falcons (*Falco lanarius*) from Eastern Europe, presented by the Baron D'Epremesnil; a Blue and Yellow Macaw (*Ara ararauna*) from South America, presented by Mrs. George Quish; a Gannet (*Sula bassana*), British, presented by Mr. J. H. Gurney, F.Z.S.; two Common Chameleons (*Chamæleon vulgaris*) from North Africa, presented respectively by Mr. Charles T. Port, F.Z.S., and Mr. T. H. Carlton Levick; a Common Viper (*Vipera berus*), British, presented by Mr. W. H. B. Pain; a Porto Rico Pigeon (*Columba corensis*), a Triangular-spotted Pigeon (*Columba guinea*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

M. THOLLON'S MAP OF THE SOLAR SPECTRUM.—M. Thollon, in the *Bulletin Astronomique* for July, gives some interesting details concerning the great map of the solar spectrum which he presented to the Paris Academy of Sciences about a year ago. He had completed an earlier design in 1879, but the positions of the lines in it had not been determined with the precision he desired. He therefore resolved to go over the work again, and to make a chart which should represent the positions, breadths, and relative intensities of the lines as faithfully as possible. The work has required four years of continuous toil to carry it from A to *b*, at which point M. Thollon now leaves it. M. Trépied proposes to carry it on to the violet. M. Thollon's map shows the spectrum under four different aspects: as seen when the sun is 10° high, and the air contains but little water-vapour; then as with the sun at 30° of altitude, first with the air saturated with water-vapour, and next when the air is very dry; and, lastly, the solar spectrum as it would be seen outside our atmosphere. It is therefore easy to see which lines are truly solar, which due to water-vapour in our atmosphere, and which to dry air. M. Thollon finds the dry-air lines limited to the great groups A, B, and *α*, which M. Egoroff ascribes to oxygen. Besides the water lines, which are arranged in seven groups, M. Thollon on a single occasion observed a vast number of telluric lines between *α* and D, the special origin of which he was not able to determine.

The measures were made with a very fine glass pointer, which allowed a bisection of a line to be made with great exactness, the probable error of an observation being less than 1/700 of the interval between the D lines. The breadth of a line was determined by observing at what distance from its extreme point, the glass pointer was equal to it in breadth. The intensity of the lines were estimated by eye. The map, which will be published in the *Annales de l'Observatoire de Nice*, is more than 33 feet in length, and embraces more than a third of the visible spectrum. From the scale on which it is drawn, the number of lines—about 3200—which it contains, the precision of the measures, and the fullness of the information given concerning the telluric lines, it will be, that which its author has striven to make it, the fullest and most perfect chart of the spectrum yet published. One of the chief purposes which it will serve will be to afford information as to the occurrence of changes in the spectrum, and M. Thollon shows by a diagram of the spectrum between B and C that we have strong reason to suspect that several lines have greatly altered in intensity since the date of Ångström's famous chart.

COMET FINLAY.—Mr. Finlay, of the Cape of Good Hope Observatory, discovered a comet on September 26. It appears to be probably identical with Comet 1844 I., its elements being given by Dr. Holetschek as follows:—

T = 1886 Nov. 22·6821 Berlin Mean Time.

$$\left.\begin{array}{rl} \pi - \Omega = & 299^\circ\ 14'\ 21'' \\ \Omega = & 48\ \ 35\ \ 55 \\ i = & 3\ \ 23\ \ \ 0 \end{array}\right\} \text{Mean Eq. } 1886{\cdot}0.$$

$$\log q = 0{\cdot}08793$$

Ephemeris for Berlin Midnight

1886	R.A. h. m. s.	Decl. ° ′	Log Δ	Log *r*	Brightness
Oct. 19	18 8 10	26 40·2 S.	0·1442	0·1249	1·37
23	18 21 52	26 33·9	0·1410	0·1173	1·44
27	18 36 11	26 22·2	0·1378	0·1105	1·50
31	18 51 6	26 4·7 S.	0·1347	0·1044	1·57

The brightness on September 26 is taken as unity.

NEW MINOR PLANET.—A new minor planet, No. 260, was discovered by Herr Palisa at Vienna on October 3.

NEW COMET.—A new comet was discovered by Mr. E. E. Barnard on October 4. It was independently observed by Dr. Hartwig on the following night. October 5, 16h. 2m. G.M.T., R.A. 10h. 37m. 24s.; Decl. 1° 3′ N. It is described as bright and round. Daily motion + 1·5s. in R.A., and + 3′ in Decl.

THE PULKOWA OBSERVATORY.—M. Struve has issued his Annual Report for the year ending May 25, 1886. During the year the fundamental determinations of star places for 1885·0 were regularly persevered in with the great transit instrument and the vertical circle. With the former Herr Wagner and his assistants, Wittram and Harzer, observed 4785 transits. With the exception of 110 observations of the sun these refer exclusively to the 383 Pulkowa fundamental stars. With the vertical circle Herr Nyrén obtained 739 complete observations, including 105 observations of the sun. The fundamental declination determinations for 1885 would be almost completed, had not Herr Nyrén wished to repeat the observations with a reversion-prism eye-piece attached to the instrument in order to investigate certain systematic discordances. Herr Romberg, observing with the meridian-circle, obtained during the year 4359 observations, chiefly of stars with large proper motion, comet stars, &c. The great 30-inch refractor has been intrusted to Hermann Struve, and has been employed in observing the fainter double stars of Burnham's catalogues, the satellites of Mars, Saturn, and Neptune, the Maja nebula (discovered photographically at Paris), and *Nova* Andromedæ, which was easily visible on January 27. M. Struve speaks in terms of the highest approval of the instrument, both as regards its optical power and as regards the mounting, the movement of the dome, &c. The 15-inch refractor has been used by H. Struve for obtaining micrometer measures of the brighter satellites of Saturn. He has obtained 42 comparisons of Japetus with Titan, 40 of Titan with Rhea, and 23 of Rhea with Dione. Herr Backlund has continued in charge of the 4-inch heliometer, and has measured with it the relative positions of Jupiter's satellites, for a determination of the mass of Jupiter, and of the orbits of the satellites. He has also undertaken a series of measures to determine the parallax of Bradley 3077, which has a large proper motion. In the physical department of the Observatory Herr Hasselberg. using a Steinheil objective of 50 mm. aperture and 1·5 m. focal length, in combination with two bisulphide of carbon prisms, has succeeded in obtaining excellent photographic images of the solar spectrum. Between wave-lengths 4000 to 4227 on Ångström's scale, he was able to count some 650 lines, whereas Vogel's map gives but 450 in the same space. During the course of the year 140 sun pictures were taken on 110 days.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 *OCTOBER* 17–23

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on October 17

Sun rises, 6h. 29m.; souths, 11h. 45m. 24·2s.; sets, 17h. 2m.; decl. on meridian, 9° 20′ S.: Sidereal Time at Sunset, 18h. 46m.

Moon (at Last Quarter on October 20) rises, 19h. 15m.*; souths, 2h. 55m.; sets, 10h. 42m.; decl. on meridian, 16° 55′ N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury	7 46	12 34	17 22	14 33 S.
Venus	5 18	11 4	16 50	3 32 S.
Mars	10 45	14 43	18 41	22 45 S.
Jupiter	5 52	11 25	16 58	6 3 S.
Saturn	21 51*	5 53	13 55	21 19 N.

* Indicates that the rising is that of the preceding evening.

Occultations of Stars by the Moon (visible at Greenwich)

Oct.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
17	111 Tauri	5½	19 24	20 14	69 240
17	117 Tauri	6	21 9	21 17	339 322
23	B.A.C. 3538	6½	0 53	1 23	348 274
23	44 Leonis	6	2 6	2 38	344 271
23	B.A.C. 3562	6½	2 14	2 49	347 268

Oct.	h.	
20	7	Saturn in conjunction with and 3° 16′ north of the Moon.
21	4	Mercury at greatest distance from the Sun.
22	21	Venus in conjunction with and 0° 18′ north of Jupiter.